A NEW TWIST TO DEFLECTIVE EYE SPOTS IN BUTTERFLIES

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I have for long been interested in the underside markings of butterflies as deflective markings, intended to make predators attack a non-vulnerable part of the resting butterfly. The most obvious example of this is that shown by members of the Lycaenidae which have developed quite remarkably life-like false heads through the patterns and tails of their hindwings (Larsen, 1982a). We are indebted to the elegant experiments of Robbins (1980) for proof that false heads really do work in deflecting predator attack. My book on Arabian butterflies shows how the false head of one species of *Spindasis* works viewed both from above and from the side (Larsen, 1984).

The really well-developed false heads in certain members of the family Lycaenidae are the apex of deflective markings. The marginal eye-spots so common in the Nymphalid groups of subfamilies fulfil the same function. An attack by a predator is directed towards the margin of the wing, not towards the vulnerable head or body (Brakefield and Larsen, 1984). I once found a large population of *Hipparchia parisatis* Kollar in the Musandam Peninsula of Oman where some 15 percent of all specimens showed the symmetrical damage to the edge of the wings caused by large vertebrate predators such as birds or lizards (Larsen, 1982b). Such marginal eye-spots are particularly common in the Nymphalinae, Satyrinae, Morphinae, Amathusiinae and Brassolinae.

Deflective markings of this nature are obviously very different from camouflage markings, though some species are seasonally polyphenic, having a camouflaged dry season form with only traces of the eye-spots while the wet season form retains the eye-spots. This is probably related to different defensive needs during two seasons with very different climatic conditions, presumably influencing both the predator spectrum and the behaviour of the butterflies themselves (Brakefield and Larsen, 1984).

Eye-spots on the inner surfaces of wings more generally seem to have a startling function, the experiments by Blest (1957) clearly showing their effectiveness in this respect. Members of the Satyrinae often display their eye-spots with a characteristic jerking movement; the Sphingid moth *Smerinthus ocellata* reveals its large hindwing spots by jerking upwards the forewings.

It is, therefore, always somewhat disconcerting to see eye-spots which do not appear to have either a startling or a deflective function. This is the case with a number of Latin American members of the Riodinidae, especially in the genera *Mesopthalma, Semomesia, Mesosemia, Diopthalma,* and their relatives. These species have a well-developed spot at the end-cell of the forewing, apparently constructed from the

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Fig. 1. A specimen of *Diopthalma lagora* resting on the underside of a leaf (Tinalandia, Ecuador). The end cell spots are very prominent.

same type of concentric circles as in the Nymphaline and Satyrine eye-spots (Nijhout, 1980). In set specimens it is difficult to imagine how they could usefully act as deflective markings.

During a recent visit to Ecuador I was able to observe one such species in nature (*Diopthalma lagora* Herrich-Schäffer). The eye-spots in fact do seem to be deflective markings. They work only because of the special resting posture of the butterfly. It invariably settles on the underside of leaves, usually an inch or so from the edge. I observed more than 100 such landings. The wings are held flat, not folded over the back as in most butterflies, and the front legs are stretched out so that the butterfly juts out from under the leaf at a 30° angle, with the hindwings in contact with the leaf surface (see figure 1). Thus the eye-spots are clearly visible when the butterfly is at rest, which would not be the case if the butterfly adopted a normal resting posture. The deflective markings would be most effective for any predator that looked from above over the edge of the leaf.

The fact that the eye-spots in the Riodinidae are placed differently and related to resting postures implies that it is a case of parallel evolution of similar passive defence mechanisms, indicating that deflective markings have a considerable survival value.

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APLOTA PALPELLA (HAWORTH) (LEP.: OECOPHORIDAE) IN DEVON— On 1st July 1987 I found four larvae of *Aplota palpella* amongst *Hypnum cupressiforme* var. *resupinatum* on two beech trees at Ashclyst Forest, Devon (V.C. 3). Nothing emerged from one, one produced a parasite which so far can only be determined as belonging to the genus *Chelonus* and the other two produced moths on 25th and 29th July. This is the first time that the species has been recorded from Devon.

The larvae fed in strong silken tubes hidden amongst the moss. Their presence was revealed by fine sawdust like frass on the surface of the moss. Although this grew over much of the trunk, often luxuriantly, the larvae occurred only where the moss was sparse and about five to six feet from the ground. Three of the larvae fed in an area of scar tissue.

The moss grew on almost all of the neighbouring trees, most of which were oak, but I could not find larvae on these. As it was more difficult searching for tubes on their rough furrowed bark I may have overlooked them. However the two trees with larvae were at the edge of the forest and so received more light (they were not in direct sunlight) and this might be significant.

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